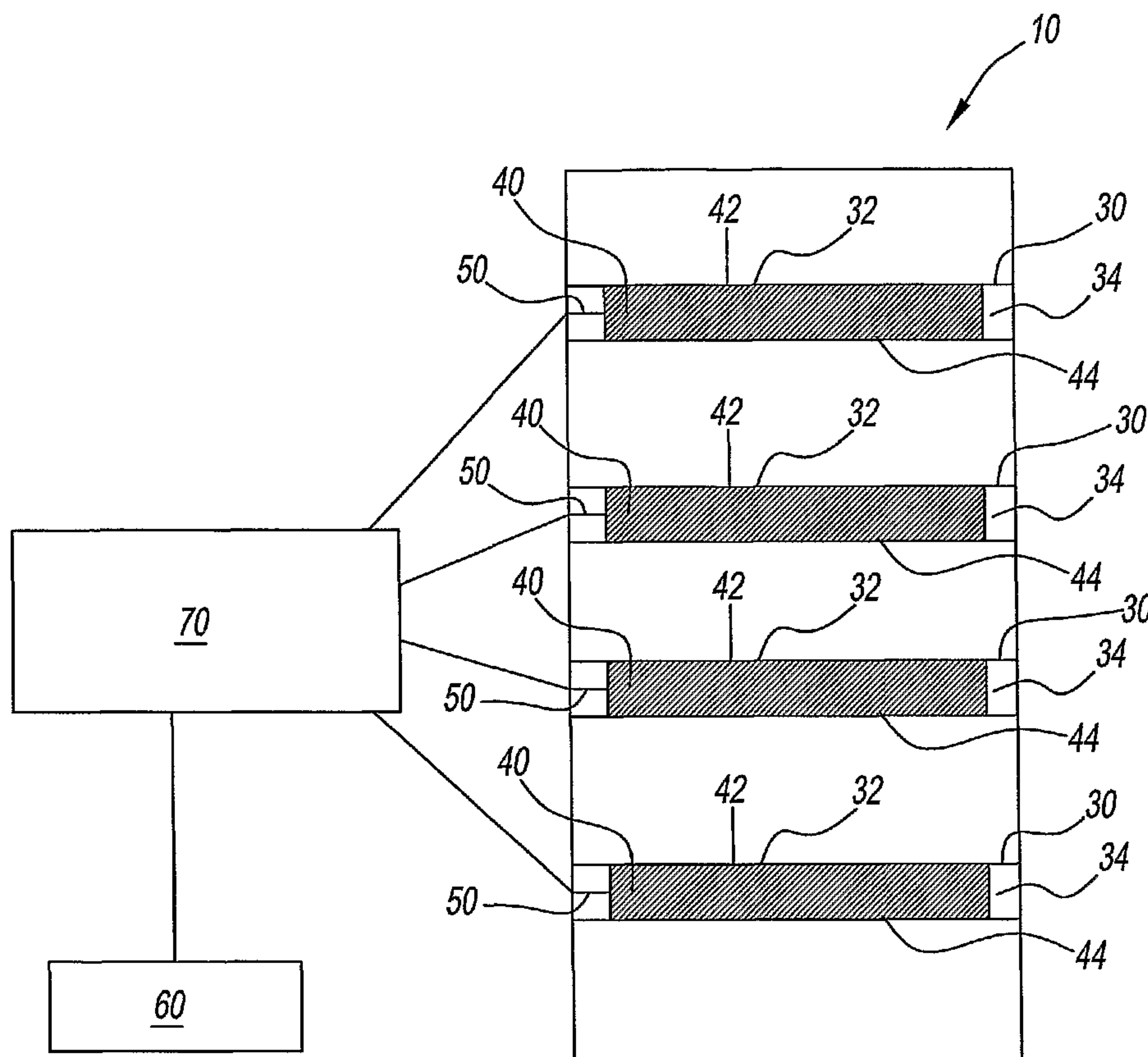




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(54) Titre : RECHAUD/CONGELATEUR MOBILE AVEC DISPOSITIFS THERMOELECTRIQUES  
 (54) Title: THERMOELECTRIC DEVICE BASED MOBILE FREEZER/HEATER



(57) **Abrégé/Abstract:**

A heating and cooling system connected to a mobile food carrying cart comprising at least one shelf (30) and one or more thermoelectric devices (40) is provided.

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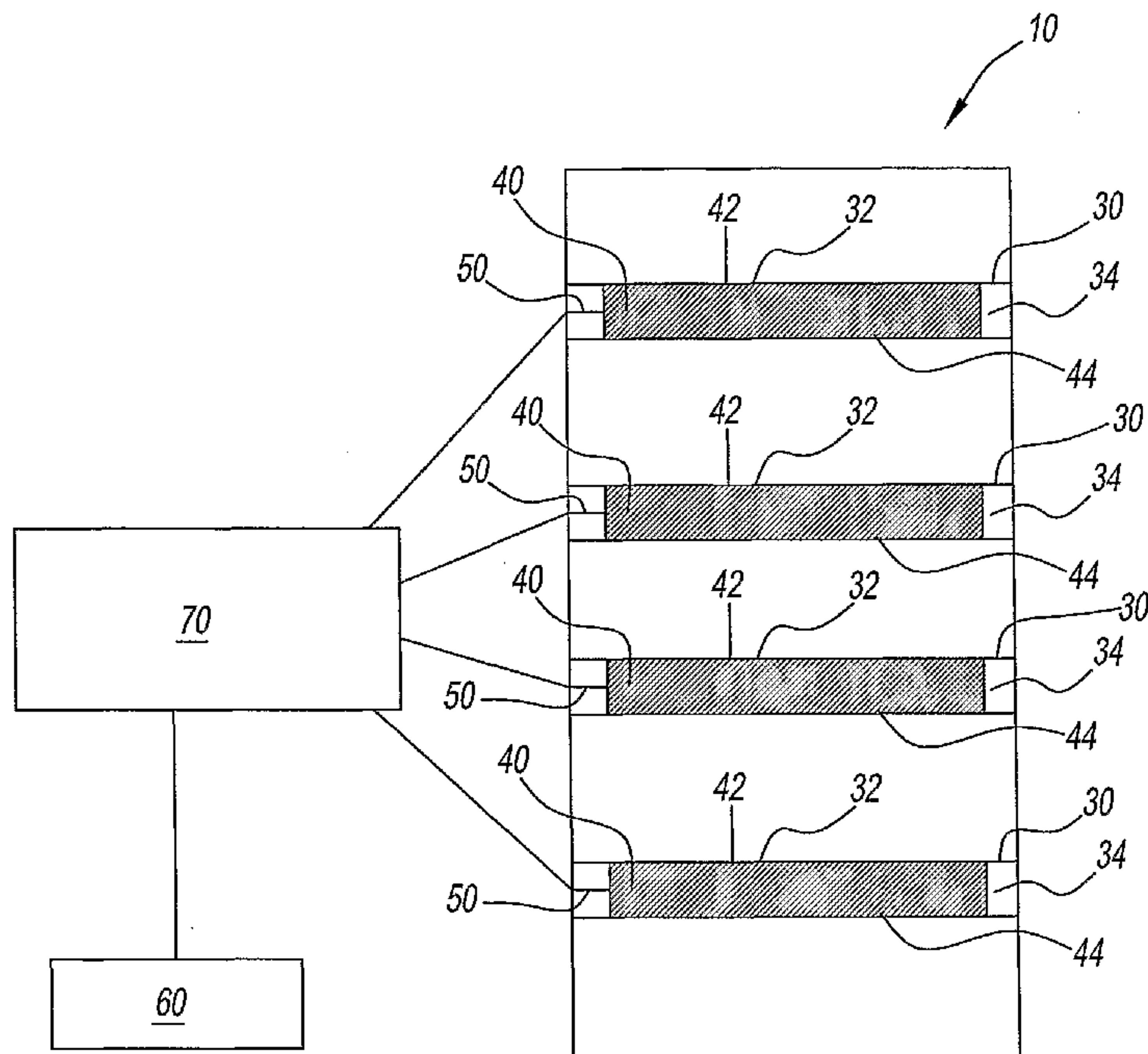
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(54) Title: THERMOELECTRIC DEVICE BASED MOBILE FREEZER/HEATER



(57) Abstract: A heating and cooling system connected to a mobile food carrying cart comprising at least one shelf (30) and one or more thermoelectric devices (40) is provided.

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## THERMOELECTRIC DEVICE BASED MOBILE FREEZER/HEATER

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

[0001] This invention relates generally to mobile food carrying carts and, more particularly, a method and apparatus for heating and cooling a mobile food carrying cart.

#### 2. Description of the Related Art

[0002] Mobile food carrying carts are used to store and ship food products to different locations at a desired temperature. In contemporary mobile food carrying carts, chilled air is circulated about the interior of the cart to cool the contents to a desired temperature. The air is typically cooled by a vapor-compression system having a vapor compression cycle. Vapor compression based cooling systems can have low coefficients of performance of less than 2.

[0003] Vapor compression based cooling systems cool all of the food products in a given cart to a fixed set temperature, which can preclude the transport of more than one food type. Moreover, the food product must be removed and heated by a separate piece of equipment, such as an oven or microwave. In addition, vapor compression based cooling systems have high noise, high vibration and a considerable weight, all affecting the mobility of the cart.

[0004] Accordingly, there is a need for an improved mobile food cart that provides efficient fine tune temperature control for the transport and delivery of different food types at their requisite temperature. The method and apparatus of the present invention provide for efficient fine tune temperature

control of food products or the like at a desired temperature through the use of a thermoelectric device.

[0005] It is an object of the present invention to provide a thermoelectric mobile food carrying cart with efficient fine tune temperature control.

[0006] It is another object of the present invention to provide a thermoelectric mobile food carrying cart with improved mobility.

## SUMMARY OF THE INVENTION

[0007] In one aspect, a heating and cooling system connected to a mobile food carrying cart is provided. The system includes at least one shelf and one or more thermoelectric devices. The one or more thermoelectric devices are connected to the at least one shelf. Each of the one or more thermoelectric devices is in thermal communication with the at least one shelf.

[0008] In another aspect, a mobile food carrying cart for transporting food products to different locations at a desired temperature is provided which comprises a support structure, at least one shelf, and one or more thermoelectric devices. The at least one shelf is removably connected to the support structure. The one or more thermoelectric devices are connected to the at least one shelf. Each of the one or more thermoelectric devices is in thermal communication with the at least one shelf.

[0009] In yet another aspect, a method of transporting food products is provided. The method comprises storing the food products in a mobile cart having one or more thermoelectric devices in thermal communication with the food products, controlling energy provided to the one or more thermoelectric

" devices connected to at least one shelf of the mobile cart, and transporting the mobile cart to a desired location for delivery of the food products.

[0010] The thermoelectric devices can have a connection socket. The cart can further comprise a control box selectively connectable to the connection socket. The cart can further comprise a power supply connected to the control box. The control box can adjustably control energy provided to the one or more thermoelectric devices from the power supply. The power supply can be selected from the group consisting of a fuel cell, a photovoltaic, a fuel or heat driven generator, an internal combustion engine, a solar cell, a battery bank, a power grid, and any combination thereof.

[0011] The thermoelectric devices can be a plurality of thermoelectric devices along a length of the at least one shelf. Each of the plurality of thermoelectric devices can be independently controllable by the control box. The cart can further comprise a vapor compression cycle connected to the mobile food carrying cart. The at least one shelf can be a plurality of shelves. The method can further comprise removably connecting a power supply to a quick connect socket. The quick connect socket can be connected to the one or more thermoelectric devices.

[0012] The above-described and other features and advantages of the present disclosure will be appreciated and understood by those skilled in the art from the following detailed description, drawings, and appended claims.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Figure 1 schematically depicts a mobile food carrying cart of the present invention; and

[0014] Figure 2 schematically depicts a thermoelectric device of the mobile food carrying cart of Figure 1.

#### DETAILED DESCRIPTION OF THE INVENTION

[0015] Referring now to FIG. 1, an exemplary embodiment of a mobile food carrying cart generally referred to by reference numeral 10 is illustrated. Cart 10 may heat, cool, and provide temperature control storage at a desired temperature for a plurality of food products, such as frozen food, fresh food, or wine for uses such as commercial or military applications. However, the present disclosure contemplates the storage and refrigeration of other such food and non-food items.

[0016] The products are stored on a plurality of shelves 30. The size, shape and number of shelves 30, as well as their configuration in cart 10, can vary with the particular needs of cart 10. Such factors as sizing, mobility, refrigeration needs, heating needs, container capacity, and others can be used by one of ordinary skill in the art to determine the particular size, shape and number of shelves 30, as well as their configuration in cart 10. In the exemplary embodiment, each of the shelves 30 has a planar, rectangular shape having tray areas 32 for the placement of each of the food products and spaces 34 each having an inner volume, preferably, opposite tray areas 32.

[0017] Each of shelves 30 has at least one of thermoelectric devices 40 disposed in each of spaces 34. Each of spaces 34, preferably, aligns thermoelectric devices 40 with each of tray areas 32 to be in thermal communication with the food products for heating or cooling. In the exemplary embodiment, each of thermoelectric devices 40 has a first side 42 facing each of tray areas 32 that is a cold side or face and a second side 44 facing away from each of tray areas 32 that is a warm side or face.

Alternatively, first side 42 may be the warm side and second side 44 may be the cold side. First side 42 can be in thermal communication with each of tray areas 32, while second side 44 can be in thermal isolation from each of tray areas 32 to provide heating or cooling. Each of tray areas 32 may be in thermal communication with more than one of spaces 34 and thermoelectric devices 40 to provide both heating and cooling. Moreover, each of shelves 30 may have more than one of spaces 34 and thermoelectric devices 40 according to the particular heating or cooling needs and other factors related to cart 10.

[0018] Through conduction, thermoelectric devices 40 heat or cool the products stored in cart 10. Shelves 30 and thermoelectric devices 40 disposed therein take advantage of the localized nature of thermoelectric heating or cooling to provide for efficient, individualized or spot heating or cooling for each of the food products. Thus, cart 10 may simultaneously store, heat, or cool more than one food product at different temperatures.

[0019] The particular type, including materials, dimensions and shape, of each of thermoelectric devices 40 that is utilized can vary according to the particular needs of cart 10. In particular, high temperature thermoelectric devices for providing maximum heating and cooling may be utilized. Thermoelectric devices 40 can be conventional thermoelectric modules used for contact cooling but could also be thermoelectric materials integrated into various heat exchanger designs, e.g, air-air, air-liquid etc., with device design choices being application specific. The particular type, including materials, dimensions and shape, of thermoelectric devices 40 can vary according to the particular needs of cart 10.

[0020] Referring to Figures 1 and 2, to provide an electric current to each of thermoelectric devices 40, a connection assembly 50 is connected thereto. Connection assembly 50 may be accessed in space 34 while thermoelectric devices 40 are disposed therein for connecting a control box 70. Connection

assembly 50, preferably, is a quick connect socket for a connection, e.g., via wiring, to control box 70. Connection assembly 50 or quick connect may extend out of each of shelves 50 to make direct contact with plugs that connect to control box 70. It is envisioned that the quick connect feature allow for easily removable shelves that are easy to maintain and/or repair. Thus, each of shelves 30 having thermoelectric devices 40 and connection assembly 50 comprises a module that may be selectively connected and disconnected to control box 70 and cart 10 for changing configuration, cleaning, or other needs of cart 10.

[0021] In the exemplary embodiment, the desired temperature of thermoelectric devices 40 may be controlled by control box 70. Control box 70 can be connected to a power supply 60, which is connected to thermoelectric devices 40. Control box 70 controls energy or current provided by power source 60 to thermoelectric devices 40, and consequently controls temperatures generated by thermoelectric devices 40 that are communicated to one or more of tray areas 32. Thus, each of thermoelectric devices 40 may provide a variety of temperatures to one or more of the food products at an identical location on one of shelves 30. For example, cart 10 may be used to cool frozen food while shipped to a location, and once at the location, the frozen food can be heated for serving prior to removal from cart 10. Not all of the frozen food stored in cart 10 may need to be heated, thus, localized thermoelectric heating can be provided to each of tray areas 32 of the frozen food to be served, while localized thermoelectric cooling can be provided to each of tray areas 32 of the frozen food to be stored. Thus, cart 10 has fine tuned temperature control for transport and delivery of different food types at their requisite temperature.

[0022] Power supply 60 may be any power source such as a DC power source from fuel cells, photovoltaics, fuel or heat driven generator, internal combustion, solar electricity cells, battery bank, or any combination thereof for providing a mobile power source, or a power grid providing power in a single

location. Moreover, power supply 60 or cart 10 may have an inverter for any AC power source.

[0023] Cart 10 may also include a vapor compression cycle for additional or alternative cooling or heating, in particular, vapor compression cycle may provide a refrigeration mode of operation.

[0024] While the instant disclosure has been described with reference to one or more exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope thereof. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the disclosure without departing from the scope thereof. Therefore, it is intended that the disclosure not be limited to the particular embodiment(s) disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A heating and cooling system connected to a mobile food carrying cart, the system comprising:  
at least one shelf (30); and  
one or more thermoelectric devices (40) connected to said at least one shelf (30), wherein each of said one or more thermoelectric devices (40) is in thermal communication with said at least one shelf (30).
2. The system of claim 1, wherein each of said one or more thermoelectric devices (40) has a connection socket (50).
3. The system of claim 2, further comprising a control box (70) selectively connectable to said connection socket (50).
4. The system of claim 3, further comprising a power supply (60) connected to said control box (70), wherein said control box (70) adjustably controls energy provided to said one or more thermoelectric devices (40) from said power supply (60).
5. The system of claim 4, wherein said power supply (60) is selected from the group consisting of a fuel cell, a photovoltaic, a fuel or heat driven generator, an internal combustion engine, a solar cell, a power grid, a battery bank, and any combination thereof.
6. The system of claim 1, wherein said one or more thermoelectric devices (40) is a plurality of thermoelectric devices along a length of said at least one shelf (30).
7. The system of claim 6, wherein each of said plurality of thermoelectric devices (40) is independently controllable by said control box (70).

8. The system of claim 1, further comprising a vapor compression cycle connected to the mobile food carrying cart.
9. A mobile food carrying cart for transporting food products to different locations at a desired temperature comprising:
  - a support structure;
  - at least one shelf (30) removably connected to said support structure;and
  - one or more thermoelectric devices (40) connected to said at least one shelf (30), wherein each of said one or more thermoelectric devices (40) is in thermal communication with said at least one shelf (30).
10. The cart of claim 9, wherein each of said one or more thermoelectric devices (40) has a socket (50) connected thereto.
11. The cart of claim 10, further comprising a control box (70) selectively connectable to said socket (50).
12. The cart of claim 11, further comprising a power supply (60) connected to said control box (70), wherein said control box (70) adjustably controls energy provided to said one or more thermoelectric devices (40) from said power supply (60).
13. The cart of claim 12, wherein said power supply (60) is selected from the group consisting of a fuel cell, a photovoltaic, a fuel or heat driven generator, an internal combustion, a solar cell, a power grid, a battery bank, and any combination thereof.
14. The cart of claim 9, wherein said one or more thermoelectric devices (40) is a plurality of thermoelectric devices along a length of said at least one shelf (30).

15. The cart of claim 14, wherein each of said plurality of thermoelectric devices (40) is independently controllable by said control box (70).
16. The cart of claim 9, further comprising a vapor compression cycle connected to said support structure.
17. The cart of claim 9, wherein said at least one shelf (30) is a plurality of shelves.
18. A method of transporting food products comprising:
  - storing the food products in a mobile cart having one or more thermoelectric devices (40) in thermal communication with the food products;
  - controlling energy provided to said one or more thermoelectric devices (40) connected to at least one shelf (30) of said mobile cart;
  - transporting said mobile cart to a desired location for delivery of the food products.
19. The method of claim 18, further comprising removably connecting a power supply (60) to a quick connect socket, wherein said quick connect socket is connected to said one or more thermoelectric devices (40).
20. A mobile food carrying cart as herein before described with reference to Figures 1 and 2 of the accompanying drawings.

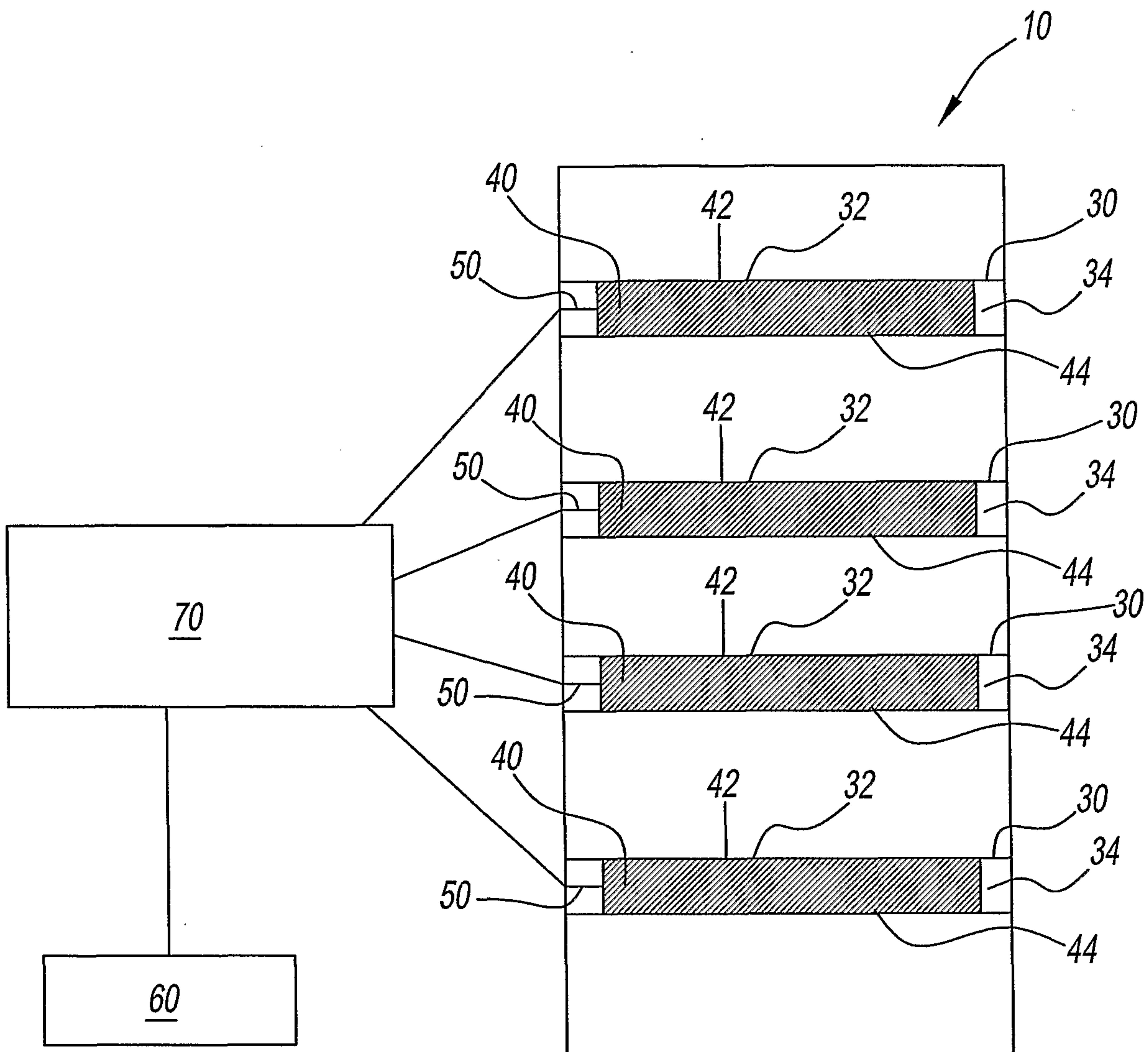


Fig. 1

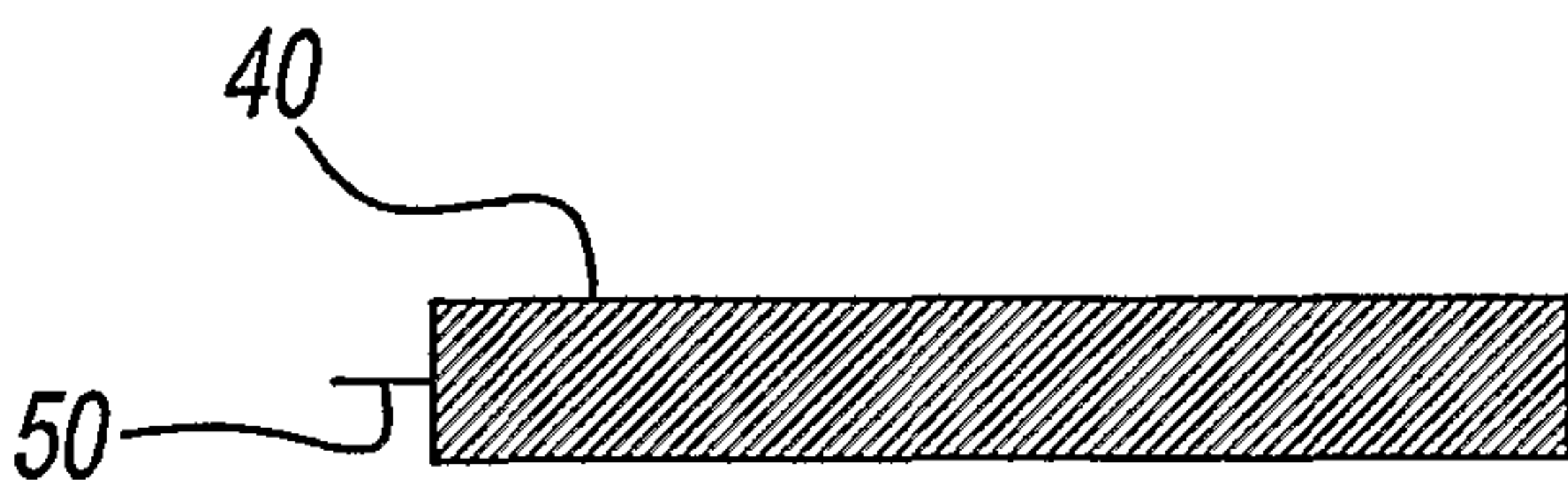


Fig. 2

